PATENT SPECIFICATION

792,157

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COMPLETE SPECIFICATION

Improvements in or relating to Turbine-Compressor Rotor Assemblies.

I, ALFRED JOHANN BUCHI, a Swiss citizen, of Archstrasse 2, Winterthur, Switzerland, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns an assembly comprising a turbine and a compressor rotor whereby the rotors are coupled together and to a shaft by which the assembly is supported for rotation.

According to this invention the assembly comprises a tubular shaft, a turbine and compressor rotor both secured to, and overhanging, the same end of the shaft a tie rod secured at one end to the turbine rotor and passing through the tubular shaft to the end thereof remote from the rotors there to receive means for tensioning the tie rod to draw the turbine rotor towards, and couple it to, the compressor rotor and also to draw the compressor rotor against the shaft and couple it thereto.

To reduce the transfer of heat from the turbine to the compressor rotor it is preferred, according to a feature of this invention, that the next adjacent faces of the rotors are provided with annular, axial ribs which are clamped together when the tie member is tensioned. This construction provides a space between the next adjacent faces of the rotors and the space may be packed with heat insulating material further to reduce transfer of heat.

Practical applications of this invention will now be described, by way of example only, with reference to the accompanying drawings of which:—

Figure 1 is a sectional elevation of a coupling device according to this invention, and

Figures 2 to 5 are similar views showing alternative constructions according to this invention.

Referring to Figure 1: the turbine rotor 1 and the compressor rotor 2 are secured to a hollow shaft 3. The shaft is formed with a head 3*a* by which the rotor 2 is supported as later described. The rotor 1 carries a tie member 4 which passes through the shaft 3 and mounted on the free end of the member 4 is a thimble 6 the skirt 6*a* of which receives an end of shaft 3. The skirt 6*a* abuts a collar 3*b* mounted on shaft 3 and engaging a part of a bearing assembly from which the shaft is supported. A nut 4*a* is on member 4 and engages the end 6*b* of the thimble so that when the nut is tightened up the member 4 is tensioned and the rotors 1 and 2 are drawn together so that the hubs of the rotors are coupled together. The hubs of the rotors are provided on their next adjacent faces with annular, axial ribs 1*a* and 2*a* respectively which are clamped together when the tie member is tensioned. By thus providing annular ribs a space is formed between the hubs so that heat transfer from the turbine to the compressor is reduced. The space may be packed with heat insulating material 12 further to reduce heat transfer.

The head 3*a* of shaft 3 has a tapering surface 3*a'* which enters a correspondingly tapering surface of rotor 2. The rotor 1 has a central nave 1*b* which closely fits an axial hole 3*a''* formed in the head 3*a* whereby the rotor 1 is radially located. Consequently the rotors are co-axially positioned on the shatf 3.

As seen in Figure 1 the tie member 4 is screw threaded into the nave 1*b* of rotor 1.

In Figure 2 the tie member 4 passes through the hub 1' of the turbine rotor 1 and is formed with a head which abuts the rotor hub.

Figure 3 shows the shaft 3 formed with a head 3*d* having a tapering portion 3*d''* and a cylindrical portion 3*d'* next to the

rotor. The hub of rotor 2 is correspondingly formed. The cylindrical portion may be further from the rotor 1 than the tapering portion, the rotor 2 being similarly formed. The cylindrical parts of head 3*d* and rotor 2 are keyed together as shown.

The rotor 2 is co-axially mounted on shaft 3 and the rotors in turn are co-axially located by a spigot joint whereof annular flange 1*c* is accurately received in a spigot 2*c* on rotor 2. The faces between the rotor hubs inwardly of the spigotted connection zig-zag as seen in axial section and said faces are uniformly spaced in the axial direction the space therebetween being packed with heat insulating material 12' which extend inwardly to the tie member 4.

In Figure 4 the shaft 3 has a head comprising a cylindrical portion 3*d* and an outwardly directed annular flange 3*d'* against which the rotor 2 is drawn, the rotor being co-axially mounted, and keyed to, the portion 3*d*. The rotor 1 is co-axially located on rotor 2 by a spigot joint as described above with reference to Figure 3.

The construction of Figure 5 is similar to that of Figure 1 wherein however the end of the tie member 4 enters hub 1' of rotor 1 and is secured thereto by welding. The member 4 could extend completely through hub 1' and be united thereto by electric welding. Such an arrangement avoids weakening of the rotor 1 as occurs with the arrangement of Figure 2.

The casing within which the assembly of rotors is mounted is shown in Figure 5 at 13, this being the part of the casing which is located between the rotors. With the devices described the part 13 may be made in one piece, the rotors being arranged separately on opposite sides of the part 13 and thereafter coupled together by the devices.

Further to prevent relative rotation of the rotors they may be additionally coupled together by pins, keys, studs or the like. In Figures 1, 3 and 4 coupling pins are indicated at 14.

What I claim is:—

1. An assembly comprising a tubular shaft, a turbine and compressor rotor both secured to, and overhanging, the same end of the shaft a tie rod secured at one end to the turbine rotor and passing through the tubular shaft to the end thereof remote from the rotors there to receive means for tensioning the tie rod to draw the turbine rotor towards, and couple it to, the compressor rotor and also to draw the compressor rotor against the shaft and couple it thereto.

2. An assembly according to claim 1 in which the next adjacent faces of the rotors are provided with annular, axial ribs which are clamped together when the tie member is tensioned.

3. An assembly according to claim 1 or 2 in which the compressor rotor has a hole which tapers to receive a correspondingly tapering portion of the shaft, the tapering surfaces being drawn together when the tie member is tensioned.

4. An assembly as claimed in claim 3 wherein the rotor hole and the shaft portion taper for only a part of the axial extent of said hole.

5. An assembly as claimed in claim 1 or 2 in which a cylindrical part of the shaft enters a cylindrical hole in the compressor rotor and the shaft has an outwardly directed annular flange against which said rotor is drawn.

6. An assembly as claimed in any preceding claim in which the tie member is screw threaded into the turbine rotor.

7. An assembly as claimed in any one or more of claims 1 to 5 wherein the tie member is welded to the turbine rotor.

8. An assembly as claimed in any preceding claim 1 to 5 in which the tie member passes through the turbine rotor and is formed with a head which abuts the rotor.

9. An assembly as claimed in any preceding claim wherein the turbine rotor has a central nave to enter the tubular shaft whereby the rotor is radially located.

10. An assembly according to any preceding claim in which the abutting faces of the rotors are spigotted together whereby the rotors are maintained concentric.

11. An assembly according to any of claims 1 to 8 in which the turbine rotor has a central nave to enter the tubular shaft radially to locate the turbine rotor on the shaft and the turbine rotor has an annular rib surrounding the nave which abuts the compressor rotor the faces of the rotors from the nave to the rib being spaced apart axially.

12. An assembly as claimed in claim 10 in which the faces of the rotors inwardly of the spigotted connection zig-zag as seen in axial section and said faces are uniformly spaced apart in the axial direction.

13. An assembly according to any preceding claim wherein the rotors are additionally coupled together by pins, keys, studs or the like.

14. An assembly according to any preceding claim in which the tensioning means comprises a thimble the skirt of which receives an end of the shaft and which skirt abuts a collar mounted on the shaft, the tie member passing through the end of the thimble and being screw threaded to receive a nut by which the member is tensioned.

15. An assembly comprising a turbine

and compressor rotor substantially as hereinbefore described and as illustrated in Figure 1 or Figure 2, or Figure 3 or Figure 4 or Figure 5 of the accompanying drawings.

For the Applicant :
GRAHAM WATT & CO.,
Chartered Patent Agents,
Bank Chambers,
329, High Holborn,
London, W.C.1.

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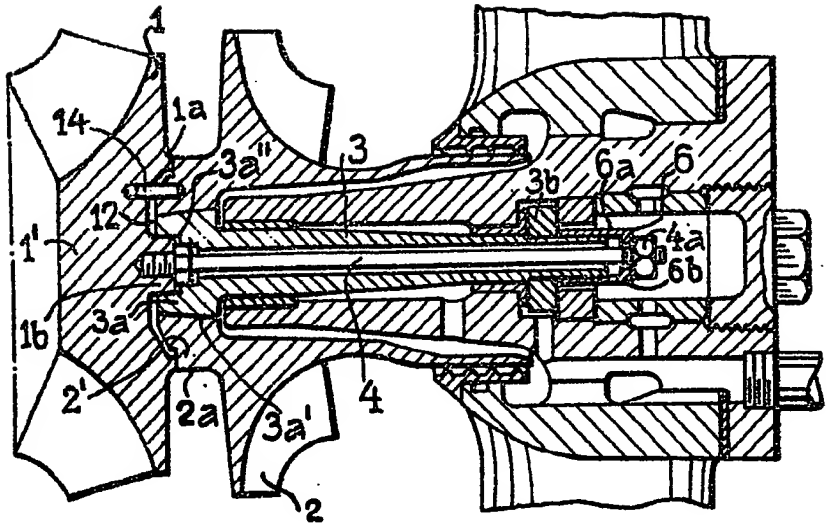
Fig.1



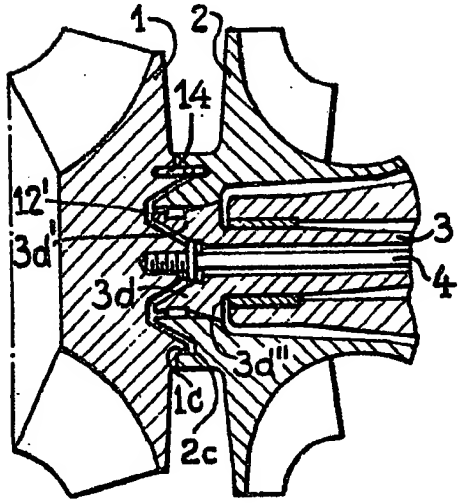


Fig.3

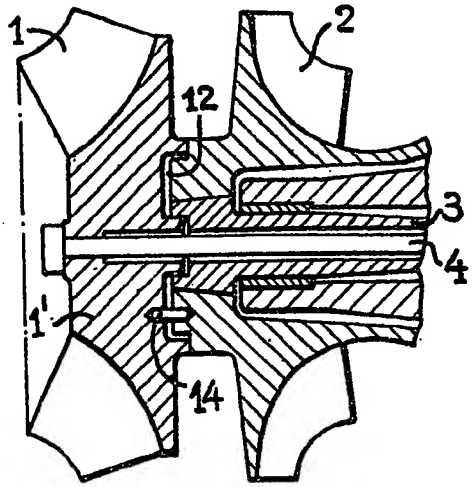


Fig.2

792,157 COMPLETE SPECIFICATION
2 SHEETS

.1

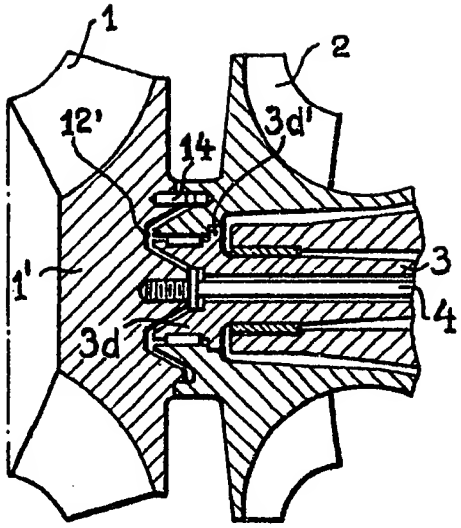


Fig. 4

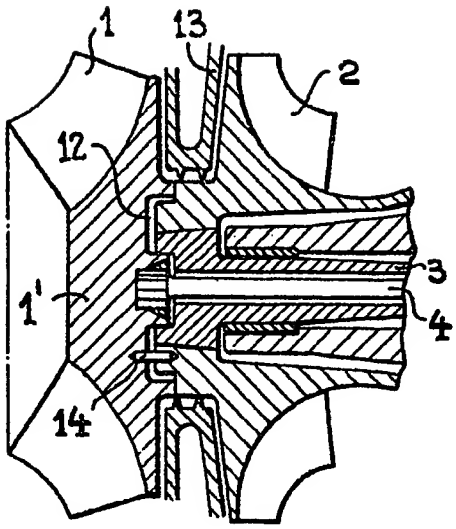


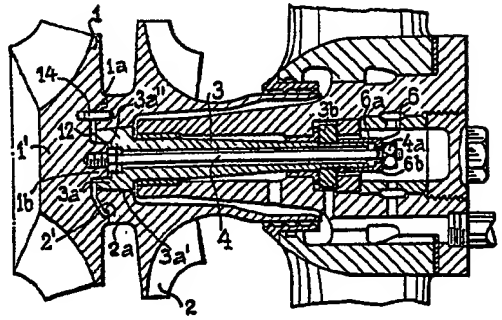
Fig. 5

2

2

792,157 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEETS 1 & 2

Fig.1



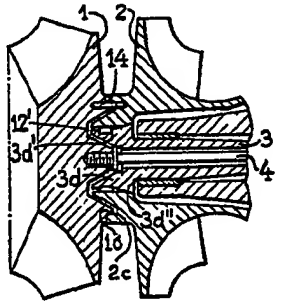


Fig.3

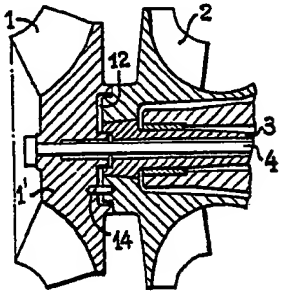


Fig.2

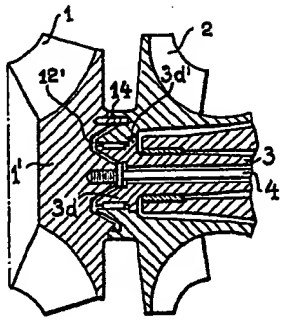


Fig.4

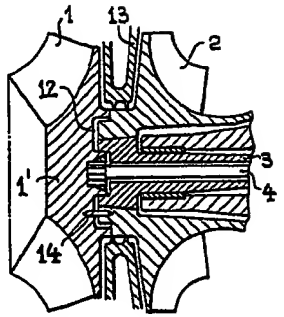


Fig.5